Advances promise high cycle life, commercial viability for electric vehicles

OAAT ACCOMPLISHMENTS

Lithium-Metal Polymer Batteries

Challenge

The development of batteries that can enable electric vehicles (EVs) to perform comparably to conventional vehicles and at comparable cost is key to making electric vehicles practical. Electric vehicle batteries must have a service life of at least 1,000 charge/discharge cycles in order to be cost effective. One of the more promising technologies, the lithium-metal polymer battery, was failing after only 100 to 200 cycles.

Technology Description

Lithium-metal polymer batteries employ thin film technology in five laminated layers: insulator, lithium foil anode, electrolyte, cathode, and metal foil current collector. The film is flexible, tough, and durable. It seals in the reactive lithium layer to prevent the corrosion that would plague lithium in more conventional battery configurations.

Lithium-metal polymer batteries can be produced through high-speed, high-quality automated manufacturing. Because each battery contains some 2.5 km (1.5 mi) of film per battery, high-speed manufacturing of the film is critical to the successful application of the battery.

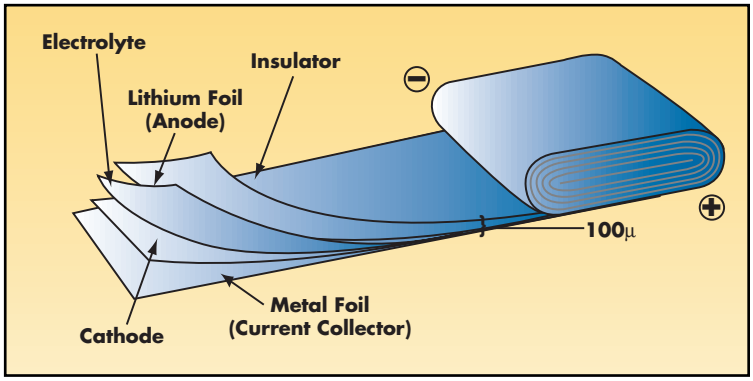
Accomplishments

Prototype lithium-metal polymer batteries have been in development for several years. Their energy density (how much energy can be stored in as little volume as possible) has gradually improved toward the commercialization goal of 150 Wh/kg.

Several improvements in the manufacturing quality of the electrochemical cells inside the batteries have been introduced, raising battery cycle life to well over 500 cycles. These include tighter tolerances, drier (lower moisture content) materials, and other proprietary improvements.

Benefits

Increasing fuel costs underscore the urgency for improving vehicle fuel economy. Lithium-metal polymer batteries can be used to power electric vehicles, virtually eliminating the vehicle's need for petroleum fuel. As the life cycle of the lithium-metal polymer battery is extended, electric vehicles will become more commercially viable.



Detail of battery layers

Both California and the Northeast states promote zero emission vehicles (ZEVs) as a means to mitigate their ozone pollution problems. Electric vehicles, which meet the ZEV standard, emit no criteria pollutants, ozone precursors, or air toxics. Electric vehicles greatly reduce pollution, even after accounting for emissions produced generating the electricity needed to recharge electric vehicles' batteries.

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Commercialization

The developer of the battery is also working on a lithium polymer battery for electric utility systems. It is anticipated that this battery will enter the marketplace several years before the electric vehicle battery. Success in the electric utility battery market will strengthen the technical and manufacturing base for the lithium-metal polymer battery, thereby enhancing the prospects for commercializing this technology for electric vehicles.

Future Activities

The developer will pursue additional improvements to increase the battery cycle life to over 1,000 cycles. Work will continue on achieving the energy density goal of 150 Wh/kg.

Partners in Success

- Argonne National Laboratory
- AVESTOR
- U.S. Advanced Battery Consortium